What is claimed is:

1. A method for simultaneous generation of motion paths depending on changes of internal and external sizes of an object by a direction map for a 2-dimensional geometric figure, the method comprising:

a first step of respectively expressing specific obstacle A and object B inputted through an input unit, by direction maps;

a second step of merging the direction maps respectively expressing the obstacle and the object;

a third step of determining Minkowski operation after sizes of the obstacle and the object are determined;

a fourth step of performing a necessary group unit based size control operation for a direction map obtained by merging each of the direction maps of the obstacle and the object in the second step;

a fifth step of performing collinear elimination for the result obtained in the fourth step, performing a direction map inverse operation, and performing a trimming operation to generate the motion path; and

a sixth step of calculating a c-space obstacle for obstacle and object having different external and internal sizes.

2. The method of claim 1, wherein in the fourth step, the boundary of Minkowski addition operation for the obstacle A and

the object B is determined using a merged direction map D_s and a group unit based size control operation by the following Equation:

$$\begin{aligned} &\partial(A_0 \oplus A_1) \\ =\ &TRIM(\partial A_0 * \partial A_1) \\ =\ &TDC(D_0 \uplus_* D_1) \\ =\ &TDC(GS(D_0 \uplus_* D_1,\ 1,\ 1)) \\ =\ &TDC(GS(D_s,\ 1,\ 1)), \end{aligned}$$

herein, the "GS" is the group unit based size control operation, the $\uplus_*$ is a convolution-merge of the direction map, the "TRIM" is an operation for eliminating an unnecessary portion of a self-cross and the like existing at the boundary, and the "1, 1" is a factor of the group unit based size control operation.

3. The method of claim 1, wherein in the fourth step, the boundary of Minkowski subtraction operation for the obstacle A and the object -B is determined using the merged direction map D_s and the group unit based size control operation by the following Equation:

$$\begin{aligned} &\partial(A_0 \ominus (-A_1)) \\ =\ &\partial((A_0^c \uplus (-A_1))^c) \\ =\ &TRIM((\partial A_0^c * \partial(-A_1))^c) \\ =\ &TDC((D_0^c \uplus_* (-D_1))^c) \\ =\ &TDC(GS(D_0 \uplus_* D_1,\ 1,\ -1)) \\ =\ &TDC(GS(D_s,\ 1,\ -1)), \end{aligned}$$

herein, the "GS" is the group unit based size control

operation, the $\uplus_*$ is the convolution-merge of the direction map, the "TRIM" is the operation for eliminating the unnecessary portion of the self-cross and the like existing at the boundary, and the "1, -1" is a factor of the group unit based size control operation.

4. The method of claim 1, wherein in the fourth step, the one obtained by merging the direction maps of the obstacle and the moving object is calculated for external and internal offsets as in the following Equation:

1) $D = DM(A_0) \uplus_* DM(A_1)$

2) $TDC(GS(D, 1, R(t))) = \partial(A_0 \oplus (R(t) \cdot A_1)) = O_{out}(R(t))$

3) $TDC(GS(D, 1, -R(t))) = \partial(A_0 \ominus (-R(t) \cdot A_1)) = O_{\in}(R(t))$

Herein, the $O_{out}(R(t))$ and $O_{\in}(R(t))$ respectively are external and internal offsets of the radius R(t).

5. The method of claim 1, further comprising a step of performing the convolution merge of the direction map after Minkowski operation is determined in the third step and before the group unit based size control operation is performed, to allow to be reused in the group unit based size control operation using a different factor.

6. The method of claim 5, wherein in the convolution-merging step, when an operation condition of $D_s = D_0 \uplus D_1$ is satisfied, the same merged direction map D_s is reused to calculate boundaries of the following four Minkowski operations:

1) $TDC(GS(D_s, 1, 1)) = \partial(A_0 \oplus A_1)$,

2) $TDC(GS(D_s, 1, -1)) = \partial(A_0 \ominus -A_1)$,

3) $TDC(GS(D_s, -1, 1)) = \partial(A_1 \ominus -A_0)$,

4) $TDC(GS(D_s, -1, -1)) = \partial(-A_0 \oplus -A_1)$, and

wherein when an operation condition of $D_d = -D_0 \uplus D_1$ is satisfied, the same merged direction map D_d is reused to calculate boundaries of the following four Minkowski operations:

5) $TDC(GS(D_d, 1, 1)) = \partial(-A_0 \oplus A_1)$,

6) $TDC(GS(D_d, 1, -1)) = \partial(-A_1 \ominus -A_0)$,

7) $TDC(GS(D_d, -1, 1)) = \partial(A_0 \ominus A_1)$,

8) $TDC(GS(D_d, -1, -1)) = \partial(A_0 \oplus -A_1)$,

herein, four factors of the group unit based size control operation applied to the Minkowski operation are

respectively defined as "1,1", "1,-1", "-1,1" and "-1,-1".

7. The method of claims 5, wherein in the convolution-merging step, when the sizes of the obstacle and the object are respectively changed into α and β, the same merged direction map is reused to calculate the boundaries of four Minkowski operations irrespective of the size as in the following Equations:

1) $TDC(GS(D_s, \alpha, \beta)) = \partial(\alpha A_0 \oplus \beta A_1)$,

2) $TDC(GS(D_s, \alpha, -\beta)) = \partial(\alpha A_0 \ominus -\beta A_1)$,

3) $TDC(GS(D_s, -\alpha, \beta)) = \partial(\beta A_1 \ominus -\alpha A_0)$,

4) $TDC(GS(D_s, -\alpha, -\beta)) = \partial(-\alpha A_0 \oplus -\beta A_1)$, and

5) $TDC(GS(D_d, \alpha, \beta)) = \partial(-\alpha A_0 \oplus \beta A_1)$,

6) $TDC(GS(D_d, \alpha, -\beta)) = \partial(\beta A_1 \ominus -\alpha A_1)$,

7) $TDC(GS(D_d, -\alpha, \beta)) = \partial(\alpha A_0 \ominus \beta A_1)$,

8) $TDC(GS(D_d, -\alpha, -\beta)) = \partial(\alpha A_0 \oplus -\beta A_1)$.

herein, the four factors of the group unit based size control operation applied to the Minkowski operation respectively are "α,β", "α,-β", "-α,β" and "-α,-β".

8. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 1 to be executed in a computer.

9. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 2 to be executed in a computer.

10. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 3 to be executed in a computer.

11. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 4 to be executed in a computer.

12. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 5 to be executed in a computer.

13. A computer-readable recording medium on which program is recorded to allow a method for generation of the 2-dimensional motion path described in claim 6 to be executed in a computer.

14. A computer-readable recording medium on which program

is recorded to allow a method for generation of the 2-dimensional motion path described in claim 7 to be executed in a computer.